Understanding, Supporting, and Assessing the Contextual Reasoning of Diverse Students

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Considered to be real-life, practical problem solving, *contextual reasoning* is the application of concrete, contextual, and in-the-moment problem solving. It is significantly less reliant on abstract and mathematical logic and deductive thinking and is used in nearly every day-to-day interaction a person has outside of the formal classroom and environment.

Contextual reasoning may also be thought of as *informal reasoning*. Currently, practitioners primarily measure formal and fluid reasoning abilities to make projections about a person's cognitive potential. However, neglecting to measure contextual and informal reasoning comes with the risk of not understanding the true potential of an individual. Formal and fluid reasoning tests do not provide a complete assessment of an individual's overall reasoning ability.

Formal Reasoning, Fluid Reasoning, and Contextual Reasoning

While formal reasoning and fluid reasoning are abstract and mathematical in nature, contextual reasoning is grounded in real-world applications and involves understanding and thinking in specific situations or contexts outside of a formalized setting. Both serve a unique purpose, and they are essential in different aspects of problem-solving and decision-making.

Formal Reasoning/Fluid Reasoning
Characterized by logical and mathematical thinking as well as abstract problem solving.

Application Academic settings including math, physics, and science, computer programming, analogical and/or novel problem solving.

Contextual Reasoning
Problem solving reliant on concrete, contextual, and practical thinking, not bound by the rules of mathematical logic and/or abstract thinking.

Application Inductive reasoning, planning and strategy, improvised problem solving.

Formal/Fluid Reasoning Vs. Contextual Reasoning in the Classroom

Formal Reasoning and Formal Learning

Individualized Learning Students learn in an independent format. Learning in class focusing on the lead instructor and the information given. Questions related to content are directed at the lead instructor, as well.

Decontextualized Material Lessons provide content knowledge that predicates the next step of the student's academic path. The skills learned in a formalized classroom primarily apply to problem solving in the same environment and are less applicable to the student's life outside of that environment.

Assessment Types/ Literacy Demonstrating content knowledge is done via formalized assessment and/or assignments completed in school and/or at home. For both means of

demonstrating knowledge, absolute, correct/incorrect, answer focus is key. This can be done either by multiple-choice and/or written response. Information is also learned and stored through written word.

Contextual Reasoning and Contextual Learning

Collaborative Learning Students work to solve new problems by combining their knowledge. Skill development may happen at different rates. Group learning may be implemented, and student groups are small enough to support engagement for each group member.
Contextualized Material Real-world application of academic skills is fundamental, connecting decontextualized material to real-life.
Assessment Types/Literacy Inductive problem-solving demonstration and real-world engagement. Group projects, skill demonstration, open-ended questions, etc. Less emphasis on literacy, greater emphasis on spoken word for teaching and transferring information.

Supporting Contextual Learning in the Classroom

Hands-On Activities Incorporate hands-on projects, experiments, or simulations to engage learners in experiential learning.
Field Trips Organize field trips or site visits to expose learners to real-world settings related to the subject matter.
Real-World Examples Provide concrete, real-life examples to connect theoretical concepts with practical applications.
Case Studies Concept or actual case studies can help students connect classroom material to real world use. They may also encourage critical thinking.
Group Discussions Can help learners by listening to different perspectives as well as hear how the learner feels.
Multimedia Resources Utilize multimedia tools such as videos, interactive simulations, and visual aids to make learning more engaging.
Practical Assignments Assign projects and tasks that require learners to put theory into practice.
Application-Based Assessments Assess learning through assignments and tests that focus on practical application rather than just rote memorization.
(For Math) Concrete-Representational Abstract Students work with manipulatives, or hands-on materials that represent mathematics problems (concrete), pictorial representations of mathematics problems (representational), and mathematics problems with numbers and symbols (abstract). The teacher explicitly bridges the connection between the concrete, representational, and abstract representations of the mathematics problems to support the student's number sense.
Flexibility Offer flexibility in the curriculum to allow learners to explore topics of personal interest within the subject matter.
Supportive Environment Create a supportive learning environment that fosters curiosity, experimentation, and exploration.
Relatable Materials Use readings and materials that are relatable to the learner's personal experiences and interests.
Feedback and Guidance Constructive feedback and guidance will help learners connect to the subject matter. Tailoring instruction to the preferences and needs of contextual learners can enhance their understanding and retention of the material.

Measuring Contextual Reasoning

Contextual reasoning can be measured through an innovative new measure: the Assessment of Nonverbal Contextual Reasoning (ANCR). Currently in standardization, the ANCR provides examiners with a new method of measuring problem solving in individuals who have historically had difficulties on performance-based, traditional assessments of intelligence, reasoning, and cognitive processing.

The ANCR requires the application of concrete, contextual, and practical problem solving and is not reliant on how well an examinee can formally think. Current data shows no significant differences in performance across racial/ethnic, parent education levels, and cultural groups, indicating this tool may measure reasoning abilities in a fair and balanced way. Below are two tables summarizing performance across groups. For subtests, raw scores are displayed. For the Test Composite, standard scores are displayed.

ANCR Performance by Group

Subtest/ Composite	All Subjects	Caucasian	Non-Caucasian	African-American	Asian/ Other	Latino/ Hispanic
Missing Pieces	16	16	16	16	15	16
Toad's Challenge	15	15	14	14	15	14
Block Towers	19	19	19	18	18	20
Analytical Thinking: P.S.	20	21	20	21	20	20
Analytical Thinking: O.C.	25	25	24	24	24	23
Test Composite	100	100	99	99	99	100
N	402	233	169	49	52	68

ANCR Performance by Parent Education Level

Subtest/ Composite	Less than College	4 Year College Degree or Higher
Missing Pieces	17	16
Toad's Challenge	15	15
Block Towers	21	18
Analytical Thinking: P.S.	21	20
Analytical Thinking: O.C.	24	25
Test Composite	102	100
N	72	330

ANCR Performance Rationale

As opposed to performance on typical measures of intelligence, reasoning, and cognitive processing, examinees' performance on the ANCR is virtually identical. This is due to the nature of the content, combined with how the examinee is being assessed. It appears that the content and the administration and scoring methods allow measurement of a more real-world form of problem solving. The result is a scale that produces balanced estimates of reasoning across different groups in the U.S. population.

Formal and Contextual Thinking Guide

Although current assessments of intelligence, reasoning, and cognitive processing do not directly measure contextual reasoning, an examinee's performance on contemporary scales can indicate the examinee's relative strengths and weaknesses in formal versus informal, contextual reasoning. The Guide below serves as a means to locate areas of strength and weakness related to these two types of reasoning and problem solving.

More Contextual Less Formal				Most Formal Least Contextual
KABC-II Block Counting	KABC-II Rover	D-KEFS Sorting	KABC-II Conceptual Thinking	WISC-V Matrix Reasoning
KABC-II Triangles	KABC-II Story Completion			WISC-V Figure Weights
KABC-II Face Recognition	WISC-V Visual Puzzles			CAS-II Nonverbal Matrices
WISC-V Block Design	D-KEFS Tower			WAIS-IV Matrix Reasoning
NEPSY-II Arrows	WAIS-IV Visual Puzzles			WAIS-IV Figure Weights
WAIS-IV Block Design	NEPSY-II Animal Sorting			KABC-II Pattern Reasoning

Helpful References and Resources

Contextual learning: Linking learning to the real world
https://www.timeshighereducation.com/campus/contextual-learning-linking-learning-real-world
10 Strategies to Build on Student Collaboration in the Classroom
https://gsehd.gwu.edu/articles/10-strategies-build-student-collaboration-classroom
Making the Transition to Classroom Success: Culturally Responsive Teaching for Struggling Language Learners
https://www.amazon.com/Making-Transition-Classroom-Success-Culturally/dp/0472035339
Informal Reasoning and Education
https://www.routledge.com/Informal-Reasoning-and-Education/Voss-Perkins-Segal/p/book/9780805802092
Does your Family Make you Smarter?
https://www.amazon.com/Does-your-Family-MakeSmarter/dp/1316604462#:~:text=The%20family%20environment%20is%20more,up%20in%20merely%20average%20households

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